1-1-2002

The Bilingual Mental Lexicon and Speech Production Process

Longxing Wei
Montclair State University, weil@mail.montclair.edu

Brain and Language **81,** 691–707 (2002)
doi:10.1006/brln.2001.2557, available online at http://www.idealibrary.com on IDEAL®

The Bilingual Mental Lexicon and Speech Production Process

Longxing Wei

Linguistics Department, Montclair State University

Published online January 22, 2002

The Chinese/English intrasentential code-switching data provide evidence that the bilingual mental lexicon involves language contact between language-specific semantic/pragmatic feature bundles. Lemmas in the mental lexicon are tagged for specific languages and contain semantic, syntactic, and morphological information about lexemes. In a bilingual mode, the speaker makes choices at the preverbal level of lexical-conceptual structure, and these choices activate the lemmas in the mental lexicon for the speaker's preverbal message to be morpho-syntactically realized at the functional level of predicate-argument structure. The result will be language-specific surface forms at the positional level of morphological realization patterns. The languages involved in the bilingual's mixed speech are never equally activated, with one language projecting the sentential frame and the other supplying a particular type of morphemes for the speaker's communicative intentions.

Key Words: lemma; mental lexicon; intrasentential; semantic/pragmatic; lexical/conceptual; predicate argument; congruence.

INTRODUCTION

This article addresses the issues of the origin and the nature of the bilingual mental lexicon and speech production process. It explores the organizational principles of the bilingual cognitive structure and speech production with special reference to Chinese/English intrasentential code switching (CS).[1] Intrasentential CS is defined as the use of two or more linguistic varieties within the sentence boundaries in the same conversation. In this article, only this type of CS is considered since intersentential CS does not tell us much about the bilingual speech production process. What occurs in intrasentential CS leads to hypotheses about principles structuring the bilingual mental lexicon and speech production process. Evidence indicates that intrasentential CS cannot be explained in terms of surface configurations. Rather, any intrasentential CS phenomenon depends on bilingual cognitively based operations of an abstract nature, and explanation of such a bilingual behavior must investigate the bilingual knowledge that underlies intrasentential CS.

Address correspondence and reprint requests to Longxing Wei, Linguistics Department, Montclair State University, Upper Montclair, NJ 07043. Fax: (973) 655-7909. E-mail: WeiL@Mail.montclair.edu.

[1] The Chinese/English CS data were collected from the daily conversations of the native speakers of Chinese who were students studying at the University of South Carolina or other universities and colleges in SC and their family dependents living with them. Tape recorders and notes were used for recording naturally occurring intrasentential CS instances. The data collection was conducted over a period of 2 years as part of the research project under NSF Grant SBR-9319780 to Carol Myers-Scotton and Janice L. Jake.

0093-934X/02 $35.00

This article considers some issues regarding the nature of entries in the bilingual mental lexicon. The mental lexicon is made up of lemmas. Lemmas are defined as abstract entries in the mental lexicon which support the surface realization of actual lexemes. Lemmas contain semantic, syntactic, morphological, and sociolinguistic/pragmatic information which is critical to a speaker's selecting one lemma rather than another (Levelt, 1989; Bierwisch & Schreuder, 1992; Myers-Scotton & Jake, 1995; Wei, 2001). This article presents three arguments. First, the bilingual mental lexicon involves language contact between language-specific semantic/pragmatic feature bundles at the preverbal level of lexical-conceptual structure. Although the noncontroversial claim is that a single mental lexicon is hypothesized for bilinguals, this article claims that this lexicon does not simply contain lexemes, but rather more abstract elements: lemmas. Each lemma is tagged for a specific language and supports the realization of an actual lexeme at the surface level (De Bot & Schreuder, 1993). But a lemma contains a good deal more than lexical specification. In addition to sociopragmatic intentional meaning, each lemma consists of subcategorization frames, which enable lemmas to ''call'' certain morphosyntactic procedures in the language production ''formulator.'' Grammatical encoding in the formulator is followed by phonological encoding. Abstract phonological codes are retrieved from the mental lexicon, with each lemma pointing to its own code, which is called its ''lexeme'' (Levelt, 1989, 1995; Roelofs, 1992; Grosjean, 1997). Second, because speech production is so rapid and fluent, morphosyntactic procedures activated by lemmas from the mental lexicon must involve parallel processing but with one procedure blind to the workings of another, a form of modularity. Intrasentential CS data provide evidence for such parallel processing and blindness. The bilingual's languages are never equally activated at the same time. That is, while both languages are turned ''on'' all the time, one language has greater input in the resulting string in bilingual speech production (Myers-Scotton, 1993, 1997). Third, bilinguals can access whatever language is the guest language in a conversation involving CS, but the lemmas activated in that language must be congruent with the base language counterparts regarding three levels of structure: lexical-conceptual structure at the conceptual level, predicate-argument structure at the functional level, and morphological realization patterns at the surface or positional level (Myers-Scotton & Jake, 1995; Wei, 2001).

Based on naturally occurring intrasentential CS instances, this article explores the nature of the bilingual mental lexicon, bilingual lemma specifications, and lemma congruence checking between languages and the principles governing bilingual speech production process.

THE NATURE OF THE MENTAL LEXICON

The mental lexicon is generally defined as the speaker's internal representation of language-specific knowledge about the surface forms. Levelt defines a lemma as the ''nonphonological part of an item's lexical information,'' including semantic, syntactic, and some aspects of morphological information (1989, p. 162). Lemmas are abstract entries in the mental lexicon and underlie the speaker's construction of the surface structure. According to Levelt, ''It is in the lemmas of the mental lexicon that conceptual information is linked to grammatical function'' (1989, p. 162). For example, the lemma entry of a verb contains several pieces of information such as its argument structure or subcategorization frame, semantic/pragmatic selectional restriction, slots for tense/aspect marking, case marking features, and so on. Thus,

lemmas contain directions regarding the three subsystems of lexical structure: lexical-conceptual structure, predicate-argument structure, and morphological realization patterns. Lexical-conceptual structure conflates universally available semantic and pragmatic information; predicate-argument structure specifies the properties of verbs in different subcategories and how the expressed arguments are encoded grammatically (i.e., how many arguments a verb may take and what thematic role each argument receives); morphological realization patterns spell out surface devices for word order, case, agreement, tense/aspect marking, and so on (De Bot & Schreuder, 1993; Myers-Scotton & Jake, 1995, 1999; Wei, 2001).

According to the above definition of the mental lexicon, there are four levels that interact during the speech production process. At the conceptual level, which is the prelinguistic level, the speaker's intentions activate semantic/pragmatic feature bundles. These activated semantic/pragmatic feature bundles point to lemmas in the mental lexicon. Thus, the second level is the lemma level. At the functional level, activated lemmas send directions to the language production formulator regarding how to construct constituents out of the three subsystems of lexical structure that are contained in lemmas. The final level is the positional level for surface structure. Levelt's (1989) model of bilingual speech production is not specifically for explaining intrasentential CS phenomena, but its theoretical assumptions about bilingual speech production processes and the levels of processing are especially relevant to the study of the nature of the bilingual mental lexicon.

The mental lexicon plays an absolutely central role in speech production. For Levelt the whole set of formulation processes is lexically driven: ''This means that grammatical and phonological encodings are mediated by lexical entries. The preverbal message triggers lexical items into activity. The syntactic, morphological, and phonological properties of an activated lexical item triggers, in turn, the grammatical, morphological and phonological encoding procedures underlying the generation of an utterance'' (Levelt, 1989, p. 181). Thus, the lexicon is assumed to be the mediator between conceptualization and grammatical, morphological, and phonological formulation.

THE BILINGUAL MENTAL LEXICON

The general assumption is that bilinguals have a single mental lexicon. Adopting Paradis' (1987) subset hypothesis, De Bot (1992), in his proposals for the organization of the mental lexicon, stipulated that L1 and L2 lexical items form different subsets belonging to one and the same lexicon and can be activated to different extents, depending on which language is currently being spoken. Therefore, the lexicon is considered to be language independent. In their discussion of second language production, De Bot and Schreuder (1993) argued that different languages lexicalize in different ways and that different language cues have different values. They suggested that information concerning language choice is contained in the preverbal message in the form of a language cue and emphasized that the preverbal message itself is not language-specific. With respect to the question of language separation in the mental lexicon, De Bot and Schreuder (1993) (also see Paradis, 1981; Green, 1986, 1993; and Grainger & Dijkstra, 1992) proposed that words belonging to a particular language form a subset that can be activated or deactivated in its entirety. Relevant to the present discussion is that when the language cue specifies a particular language, all words belonging to that language can be activated, and once they are activated, the words belonging to the other language are deactivated. The question

of whether there is one lexicon or a separate lexicon for each individual language becomes irrelevant if lexical access is described in terms of spreading activation (cf. Dell, 1986; Roelofs, 1992). The crucial questions seem to be whether lexical items belonging to different languages are related to each other and whether they can be activated equally or simultaneously.

An alternative view to the notion that only one language-specific lexicon can be activated at any time is the view that in bilinguals both lexical systems can be activated simultaneously and that entries in both lexicons are searched for an appropriate entry. For example, according to Beauvillain and Grainger (1987) and Grainger and Dijkstra (1992), in word recognition tests, initial lexical access procedures in the word recognition process are language-independent in bilinguals. These researchers suggest that when a word is presented, initially there is activation of both lexicons, with language selection occurring only at a later stage. However, simultaneous activation of both lexical systems of a bilingual does not imply that there is always an equal activation of lemmas from the languages that the bilingual knows. Lemmas from one language may receive more activation at a certain point during the discourse than the corresponding lemmas from another language if the speaker's preverbal message contains the specification of a particular language.

One of the major assumptions underlying this study is that each lemma is tagged for a specific language and supports the realization of an actual lexeme at the surface or positional level. Language-specific lemmas in the bilingual mental lexicon activate language specific sets of morphosyntactic procedures in the formulator. However, because speech production is so rapid and fluent, these procedures must involve parallel, rather than separate, processing but with one procedure in one language blind to the workings of another in a different language. Intrasentential CS data provide empirical evidence for such parallel processing and blindness, a form of modularity. The switched items show connections between lemmas in the bilingual mental lexicon and the actual word forms in the lexemes realized at the surface or positional level. The intrasentential CS data discussed in this article provide evidence that the bilingual's two languages do not equally control the selection of morphosyntactic procedures. One language has greater input in the resulting string in bilingual speech production (Myers-Scotton & Jake, 1995; Wei, 2000a,b).

The lexical items that are stored in the bilingual mental lexicon not only specify the meanings of words but also contain language-specific syntactic, morphological, and phonological information about them. Thus, the bilingual mental lexicon is defined as the bilingual's internal representation of language-specific knowledge about the surface forms. In the bilingual speech production process, the speaker's preverbal message/intention at the conceptual level activates language-specific semantic/pragmatic feature bundles, which are then mapped onto lemmas in the mental lexicon at the lemma level. Lemmas activated at the lemma level send directions for grammatical encoding to the formulator at the functional level, which is followed by morphological and phonological encoding at the positional level.

The speaker's preverbal message/intention at the conceptual level activates language-specific semantic/pragmatic feature bundles, which interface with language-specific lemmas in the mental lexicon. It is the lemmas in the mental lexicon that mediate between the conceptual level and the language production formulator. Jackendoff views the function of lexical items in a similar way, ''. . . a lexical item is to be regarded as a correspondence rule, and the lexicon as a whole is to be regarded as part of the PS-SS [Phonological Structure-Syntactic Structure] and SS-CS [Conceptual Structure]'' (1997, p. 89). The activated lemmas in the mental lexicon send directions to the formulator, which projects the language-specific morphosyntactic

procedures at the functional level (Levelt, 1989; Garrett, 1990). These projected morphosyntactic procedures result in surface forms at the positional level.

BILINGUAL LEMMA SPECIFICATION AND CODE-SWITCHING

The Nature of Lemmas in the Bilingual Mental Lexicon

Lemmas are not lexical items with subcategorization features, but they support such items. Each lemma contains a bundle of semantic and pragmatic features that encodes the lexical-conceptual structures which represent the speaker's preverbal message/intention. It also contains information as to how the preverbal message/intention is morphosyntactically realized in a sentence. An example of morphosyntactic information is lexical category with its subcategorization features. In other words, a language-specific semantic/pragmatic feature bundle selected at the conceptual level entails the predicate-argument structure associated with this bundle at the functional level, which, in turn, produces the morphological forms at the positional level. Thus, a lemma can be generally defined as a link between conceptual intentions (i.e., semantic and pragmatic features) and the predicate-argument structure and morphological realization patterns of a specific language (Myers-Scotton & Jake, 1995; Levelt, 1995).

However, the bilingual mental lexicon includes lemmas from more than one language. It is true that there is a universal set of semantic/pragmatic feature bundles that are available for the lexical-conceptual structuring of lemmas. That is, there is sufficient congruence between lemmas from both languages known to the bilingual. However, lemmas are most likely language-specific because of cross-linguistic incongruence or pragmatic considerations. Consequently, semantic or pragmatic mismatches between the two languages may result. The issue of cross-linguistic congruence or incongruence is discussed with CS instances in the sections below.

Content vs System Morpheme Distinction

There is every good reason to claim that content and system morphemes are accessed differently in either monolingual or bilingual speech production.[2] Prototypical content morphemes are nouns, most verbs, descriptive adjectives, most prepositions, and free-standing pronouns. Prototypical system morphemes are quantifiers, specifiers, and inflectional affixes. More formally, one can say that content morphemes have a plus setting for the feature [+thematic role assigner/receiver]. That is, content morphemes are potential thematic role assigners or receivers. System morphemes have a minus setting for this feature. However, there exists cross-linguistic variation in the assignment of morphemes to either content or system morpheme status. Different languages may assign particular lexical concepts to content or system morphemes

[2] The content vs system morpheme distinction predicts variation in morpheme membership within particular lexical categories, and this distinction differs from other proposals characterizing the content vs. function distinction. Joshi (1985) and Emonds (1985) propose the open vs closed class distinction. This distinction suffers from the deficiencies which assign status on the basis of lexical category membership. For example, not all prepositions are closed class items. Abney (1987) proposes that the feature [±functional] be category-defining. This category-defining feature encounters similar deficiencies. For example, while Abney categorizes all pronouns as functional elements, the psycholinguistic (e.g., Friederici, Weissenborn, & Kail, 1991) and CS literature (e.g., Myers-Scotton & Jake, 1995, 2000) provide the evidence that some pronouns in some languages are not functional (system) morphemes, but content morphemes.

differently. That is, not all members of a particular lexical category will pattern alike. Guest language morphemes may be conceptually congruent with base language counterparts, but they may differ in their status as content or system morphemes. (For cross-linguistic variation and categorization of morphemes, see Jake, 1994, 1998; and Myers-Scotton & Jake, 2000.) The intrasentential CS data indicate that content and system morphemes are accessed differently. That is, these two types of morphemes have different types of lemma entries in the mental lexicon. Below are some of the intrasentential CS examples.[3]

(1) ni nei-pian *article* hai mei *finish* a?
you that-CL yet not PART/AFFIRM-QUE
''You haven't finished that article yet?''

In (1) ''article'' and ''finish'' are content morphemes from English, but ''nei'' (equivalent to ''that'') and ''pian'' (a Chinese classifier) go together as a determiner. A classifier is a word or morpheme that indicates a semantic class of nouns and regularly accompanies any noun of that class in certain syntactic constructions. A Chinese classifier must always be used together with a singular demonstrative like ''this'' or ''that'' or a specific number like ''one,'' ''two,'' and so on. When this combination occurs with a content morpheme head, it syntactically functions as a system morpheme. However, when the same combination receives a thematic role, it becomes a content morpheme. For example, when we say ''gei wo nei-ge'' (''give me that''), ''nei-ge'' (''that,'' classifier) here, of course, is assigned a thematic role. See Wei (2000a,b) for the discussion and categorization of morphemes. Also, there is no perfect aspect marking on the English verb ''finish,'' since Chinese does not have verb morphology of any sort for this and other grammatical purposes. Chinese does have a morpheme which realizes the concept of ''aspect,'' but the verb itself is not inflectional. In Chinese, the morpheme ''le'' is used to indicate that the action/activity has been completed; ''le'' is a system morpheme in the same way as English ''-ed,'' including its irregular forms, which is required by the verb in realizing ''aspect'' or ''voice.''

(2) wo *summer* bu *take course* le.
I not PART/AFFIRM
''I won't take any course in summer.''

In (2) the noun ''summer'' and the verb phrase ''take course'' are English content morphemes. It should be noticed that the Chinese similar preposition ''zai'' (''in'') is optional in realizing an adverbial of time or place. Also, while in English an explicit auxiliary, a system morpheme, is always required to negate the predicate verb, in Chinese only a negative particle like ''bu'' (''not''), ''mei'' (''not'') or other similar negative particles is required to negate the predicate verb.

(3) tingshuo ni *in May graduate*, shi ma?
hear you right PART/INTERROG
''I heard you will graduate in May, won't you?''

In (3) both ''in'' and ''May'' are content morphemes. The prepositional phrase ''in May'' expresses content because it is an adverbial phrase of time. Also, the verb

[3] Abbreviations in glossaries for CS examples: AFFIRM = affirmative; CL = (Chinese) classifier of noun; COP = copula; EMPH = emphatic; INTERROG = interrogative; LOC = location; PART = particle; PERF = perfective; PREP = preposition; QUE = question marker.

''graduate'' is an English content morpheme. As predicted, English system morphemes like ''will'' for tense marking are not switched.

(4) naxie *visiting scholar* bu shi hen youqian ma.
those not/EMPH COP very rich PART/AFFIRM
bi women *student* youqian duo le.
PREP/than us have money more PART/AFFIRM
''Those visiting scholars are really very rich. They have a lot more money than us students.''

In (4) the noun phrase ''visiting scholar'' and the noun ''student'' are English content morphemes. The determiner ''naxie'' (''those''), a system morpheme, is from Chinese. It should also be noticed that there is no plural morpheme ''-s,'' an English system morpheme, for ''visiting scholar'' or ''student.''

(5) shi-bu-shi qu nei-ge *new library*?
yes-not-yes go that-CL
''Are we going to that new library?''

In (5) the noun phrase ''new library'' is from English, but again the determiner ''nei-ge'' (''that,'' Chinese classifier), a system morpheme, is from Chinese.

To summarize briefly, the above examples show that while content morphemes from the guest language (here, English) can appear in the sentences involving intrasentential CS, all system morphemes must come from the base language (here, Chinese), even if there is no system morpheme available in the base language for the same grammatical purpose. The reason all system morphemes come from the base language is specified by the system morpheme principle in the following section.

Matrix vs Embedded Language Distinction

The languages participating in intrasentential CS have unequal roles in bilingual speech production. One language is more central in sentential frame building. This language is called the Matrix Language (ML). The more secondary language is called the Embedded Language (EL) (Myers-Scotton, 1993, 1997). The ML is more activated and the occurrence of its morphemes is freer than that of the EL. The ML must be identified by the convergence of more objectively based measures. First, the ML is the language of relatively greater morpheme frequency, if a discourse sample of two or more sentences involving intrasentential CS are studied. Second, the ML is the language which the speakers engaged in intrasentential CS will identify as the ''main language'' being used. Third, the ML is the language which projects the sentential frame in the morphosyntax of mixed constituents.

Myers-Scotton (1993, 1997) formulated two principles, the *Morpheme Order Principle*, which states that in mixed constituents, surface morpheme order must not violate that of the ML; and the *System Morpheme Principle*, which states that in ML + EL constituents, all system morphemes which have grammatical relations external to their head constituent (i.e., which participate in the sentence's thematic role grid) will come from the ML. That is, EL system morphemes are not free to occur in intrasentential CS in the same manner as content morphemes. In the examples (1)–(5) above, all the system morphemes are only from Chinese, the ML, rather than from English, the EL. (See the CS data from various language pairs and tests on

these two principles in Myers-Scotton, 1993, 1997; Myers-Scotton & Jake, 1995, 2000; and Wei, 2001.)

Although Chinese and English share the same basic V-O order, Chinese is very flexible in the arrangement of sentential elements. For example, in (1) the object ''nei-pian article'' (''that article'') goes before the verb; in (2) the adverbial of time follows the subject rather than the verb, and again in (3) the adverbial of time ''in May'' is placed immediately before the verb. Such word orders are not permitted in English, but they are some of the typical Chinese grammatical patterns.

To summarize briefly, to call ML+EL constituents ''mixed'' obscures their highly systematic nature. They regularly consist of an ML morphosyntactic frame (i.e., system morphemes and morpheme order) into which content morphemes from the EL are inserted. This evidence leads us to claim that in bilingual speech involving intrasentential CS, the constituent frame is constructed by higher order procedures called only by the ML. Either ML or EL lemmas may call the procedures which insert ML or EL content morphemes respectively into the frame, but only the EL lemmas which are congruent with the ML counterparts are possible.

Lemma Congruence Checking Principle

''Congruence'' is defined as ''a match between the ML and the EL at the lemma level with respect to linguistically relevant features'' (Myers-Scotton & Jake, 1995, p. 985). All lemmas include three levels of abstract lexical structure, and this structure figures in explaining and predicting possible intrasentential CS configurations. At the level of lexical-conceptual structure lexical access takes place on the basis of the information contained in the speaker's preverbal message/intention. This is because the speaker's preverbal message/intention in the conceptualizer activates language-specific semantic/pragmatic feature bundles at the interface between the conceptualizer and the mental lexicon, and these activated semantic/pragmatic feature bundles are then mapped onto lemmas in the mental lexicon as lexical-conceptual structure. Green (1986, 1993) assumes that a lemma is activated if it matches part of lexical/conceptual structure created by the conceptualizer. At the level of predicate-argument structure thematic structure is mapped onto grammatical relations. At the level of morphological realization patterns surface grammatical relations (e.g., word order, agreement morphology, and case marking), including phonological forms, are realized. Thus, lemma congruence between languages is regarded as a basic organizing principle governing intrasentential CS. The intrasentential CS data provide empirical evidence for this principle. Relevant to the current study is lemma congruence checking at the first two of these three levels of abstract lexical structure.

Lemma congruence checking at the level of lexical-conceptual structure. It is generally assumed that there is a universal set of semantic and pragmatic features available for the lexical-conceptual structuring of lemmas, but there is also cross-linguistic variation in the presence and conflation of these features. Speakers select individual content morphemes to encode their intentions. However, at the conceptual level speakers do not produce surface level morphemes but rather make appropriate choices about the semantic and pragmatic information which they intend to convey. The information chosen at this abstract level activates the lemmas in the mental lexicon which will support surface level morphemes. Most Chinese/English CS examples studied in this article show sufficient congruence between the ML and the EL at the level of lexical-conceptual structure in terms of semantic/pragmatic feature bundles (i.e., congruence between the ML and the EL lemmas which support existing lexemes in both languages). Most Chinese/English intrasentential CS examples show that most EL content morphemes can be switched into the ML sentences because these

morphemes are projected from the EL lemmas whose semantic/pragmatic feature bundles are sufficiently congruent with those of the ML counterparts.

In other cases, the language pairs involved in intrasentential CS may differ in semantic/pragmatic feature bundles encoded in lexical/conceptual structure. However, such difference is only partial and thus there is still sufficient cross-linguistic congruence. Bilingual speakers may switch to the EL lexeme at a certain point during the discourse involving intrasentential CS. Below are some of such examples.

(6) wo xiawu qu jian wode *advisor*. wo bu neng he ni yiqi qu *mall* le.
I afternoon go see my I not can with you together go
PART/AFFIRM
''I'm going to see my advisor this afternoon. I can't go to the mall with you.''

In (6) an English ''advisor'' assumes more responsibilities than a Chinese advisor. In the academic context an English advisor is a professor or instructor who gives advice or counsel to the student regarding his/her academic progress, improvement, course requirements and sequential arrangement, thesis/dissertation writing, research in progress, and so on. In addition, most English advisors are those who will also recommend their students to professional agencies. In comparison, although Chinese possesses the equivalent lexeme ''daoshi'' (''advisor''), a Chinese advisor does not have the same responsibilities as those of an English advisor. In China only a graduate student may have a ''daoshi,'' whose only responsibility is to guide the student in writing his/her thesis/dissertation.

(7) wo you liang-fen *paper* mingtian bixu jiaoshangqu, ke wo xianzai yi-fen hai mei *finish* ne.
I have two-CL tomorrow must turn in but I at the moment
one-CL yet not PART/AFFIRM
''I must turn in two papers tomorrow, but at the moment I haven't finished one yet.''

Similarly, while in (7) an English ''paper'' may mean an article, a report, an essay, a composition or any written piece of schoolwork, the Chinese equivalent lexeme ''zhi'' (''paper'') itself only means ''a piece of paper to write on or to wrap things up in.'' Another example of such cross-linguistic differences in semantic/pragmatic feature bundles is given in (8):

(8) zhu zai zheli hen fangbian, meitian you *school bus.*
live PREP/LOC here very convenient everyday have
''It's very convenient to live here since there is a school bus everyday.''

While in English a ''school bus'' is a bus for transporting students to and from the school, the Chinese equivalent ''xiaoche'' (''school bus'') usually only transports the school's sports or performance team or only carries equipment for the school. It should be clear that bilinguals select lexemes from another language at a certain point during the discourse involving intrasentential CS because of such cross-linguistic differences in semantic/pragmatic feature bundles.

This study assumes that although in all languages it is possible to express all semantic and pragmatic intentions, actual lexicalization patterns may differ cross-linguistically. In many cases exact translation across languages is impossible or in-

complete (Li, 1996; Nishimura, 1997; Wei, 2001). This is because language cues may have different values. In the case of intrasentential CS, the speaker may ignore the ML cue and switch to an EL lexical item when no ML lexical item is available to express the speaker's intended meaning. In other words, when the language cue specifies a particular language at a certain point of bilingual speech production, the lexical item from that language receives activation. According to De Bot and Schreuder (1993), bilingual speakers are able to separate different language systems and to mix them for their communicative intentions. Bilingual speakers are able to do so by making language choices in the preverbal message. This means that conceptual information and the language cue must work together in activating appropriate language-specific lemmas in the mental lexicon to serve the speaker's communicative intention.

Lemma congruence checking at the level of predicate-argument structure. Figure 1 shows that during the process of speech production, the speaker's preverbal message/intention at the conceptual level activates the appropriate language-specific lemmas for the lexical items in the mental lexicon. The activated lemmas send directions to the formulator, which in turn projects the morphosyntactic procedures for those lexical items. The question is which of the two languages involved in intrasentential CS controls the morphosyntactic procedures, since lexical items from both languages can be activated at a certain point of bilingual speech production.

As mentioned above, one of the languages involved in intrasentential CS is the

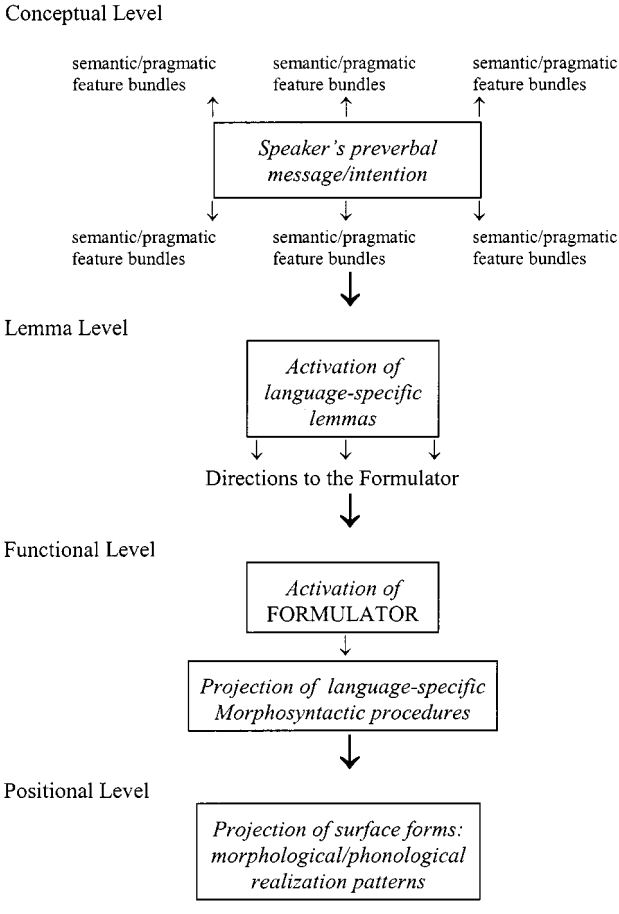

FIG. 1. Lemma activation in the bilingual mental lexicon (adapted from Myers-Scotton & Jake, 2000).

ML, and it is the ML which sets the sentential frame into which the EL content morphemes are switched. Thus, only the ML controls the predicate-argument structure by supplying system morphemes, a subcategorization frame for the verb, and morpheme order. However, before morphosyntactic directions are sent to the formulator, lemmas from both languages can be activated at a certain point during intrasentential CS. Thus, the checking for congruence at the level of lexical-conceptual structure alone is not sufficient enough for intrasentential CS to occur. The checking for congruence at the level of predicate-argument structure supported by an EL lemma and its ML counterpart must come into play.

The Chinese/English intrasentential CS examples indicate that the speakers tend to use many EL verbs and verb phrases as well as EL nouns and noun phrases. One of the obvious reasons for this is that Chinese and English share the same basic V-O order. The speaker may simply switch the EL verbs/verb phrases or nouns/noun phrases into the syntactic slots prepared by the ML. Most examples discussed in this article show that there is sufficient congruence between the EL and the ML lemmas underlying the realization of an EL content morpheme, either a single verb or a verb with its complement noun, in the ML morphosyntactic frame. Below are some typical examples.

(9) ta gang dao, ta dei xue *drive.*

he just arrive he must learn

''He just arrived and must learn how to drive.''

In (9) the infinitive verb ''drive'' is used here as the object of the main verb ''xue'' (''learn'') in exactly the same order as in English, with the exception that Chinese does not possess the infinitive marker ''to.''

(10) ni dei xiang bangfa *make money.*

you must think way

''You must think of ways to make money.''

In (10) the verb phrase ''make money'' follows the V-O order in both languages.

(11) wode che you *give me trouble* le.

my car again PART/PERF

''My car gave me trouble again.''

In (11) the verb phrase ''give me trouble'' follows the V-O-O double object order in both languages.

However, there also exist apparent differences between Chinese and English in some of their morphosyntactic features. Chinese does not possess inflectional morphemes for tense, aspect, voice, or person/number marking or grammatical devices such as the infinitive marker ''*to*'' and the dummy subject pronoun ''*it/there*.'' In addition, Chinese shows two major differences from English in its morphosyntactic patterns. One is the category of the head of a maximal projection, and the other is the grammatical argument structure (cf. Talmy, 1995; Wei, 2000a) [see examples (18)–(21) below]. The issue of incongruence is discussed in the following subsection.

Incongruence and the compromise strategy. Languages may differ at any of the three levels of abstract lexical structure. Languages do not lexicalize concepts in the same way, and thus lexical representations are language-specific. The existence of lack of sufficient congruence between languages requires some compromise strategies for intrasentential CS to occur. One of the compromise strategies is the produc-

tion of EL islands (Myers-Scotton, 1993, 1997; Jake & Myers-Scotton, 1997). In an EL island, an EL content morpheme occurs entirely with only other EL morphemes, including EL system morphemes, in a constituent. Whenever an EL lemma is selected which does not have a match with that of the ML, then the formulator must produce an EL island. Incongruence between the language pairs involved in intrasentential CS in regard to semantic/pragmatic feature bundles or predicate-argument structures are two of the major reasons for EL islands to be formed if the EL lemmas are selected for the speaker's communicative intention. Examples (12)–(14) show incongruence across the EL and the ML semantic/pragmatic feature bundles.

(12) na wo yi dian *come to pick you up.*

so I one o'clock

''So, I'll come to pick you up at one o'clock.''

In (12) ''pick you up'' occurs as an EL island because the speaker chooses the EL lemma's lexical-conceptual structure the whole phrasal verb with a pronominal object before the particle satellite ''up'' is accessed. The speaker prefers ''pick up'' for the possible reason that this phrasal verb contains the meaning of ''to take on as a passenger,'' but the Chinese equivalent verb ''jie'' (''meet'') usually does not. It should also be noticed that ''come'' is accessed together with the infinitive clause ''to pick you up'' as an EL island. The possible explanation is that the English infinitive marker ''to,'' a system morpheme, becomes obligatory if two successive EL verbs are activated and selected simultaneously.

The point here is that certain verbs or verb phrases can be easily switched into the ML sentential frame because of the sufficient congruence between the ML and the EL phrase structure rules of verbs. Like (9)–(11), (12) shows that the verb with an infinitive clause from the EL is activated and switched into the syntactic position of the Chinese predicate-argument structure. The difference is that the speaker selects the EL phrasal verb ''pick up'' to fill in the gap between the ML and the EL semantic/pragmatic feature bundles.

(13) name ni mingtian *call me.*

then you tomorrow

''Then you call me tomorrow.''

In (13) the semantic features of ''communicate with by telephone'' are conflated in the verb ''call,'' but the Chinese equivalent to ''call me'' is ''da dianhau gei wo'' (literally translated as ''make phone to me''). Since the speaker chooses the EL lemma which activates the EL lexical-conceptual structure, the whole VP is accessed as an EL island.

(14) ni neng-bu-neng *give me a ride*?

you can-not-can

''Can you give me a ride?''

In (14) ''give me a ride'' is incongruent with the ML counterpart ''song wo yixia'' (literally translated as ''send me one time''). While in the EL the lexical-conceptual structure of the means of transportation is conflated in the noun ''ride'' as the direct object of the verb, in the ML it may be conflated in the verb ''song'' because the verb itself may not contain the meaning of transportation at all. The speaker chooses the EL expression probably because he wants to be more specific than he can be

with the Chinese structure. Thus, when the EL lemma is activated, the whole VP is accessed as an EL island.

Further examples showing cross-linguistic differences in semantic/pragmatic feature bundles are frequently found in the speakers' choices of certain fixed/idiomatic expressions from the EL.

(15) ni qu-bu-qu K-mart? tingshuo you xuduo dongxi *on sale.*
you go-not-go hear have many things
''Are you going to K-mart? I've heard there are many things on sale.''

(16) wo zuotian qu Kinko's fuyin ji-fen *paper.* nali you wu-tai jiqi
I yesterday go xerox a few-CL there have five-CL machine
dan san-tai shi *out of order.*
but three-CL COP/be
''Yesterday I went to Kinko's to xerox a few papers. There were five machines there, but three of them were out of order.''

(17) wo bu neng baozheng dao ni jia *on time,* ban wo yiding lai.
I not can guarantee arrive your home but I surely come
''I can't guarantee that I'll arrive at your home on time, but I'll surely come.''

The PP's in (15) (''on sale''), in (16) (''out of order''), and in (17) (''on time'') are accessed as the EL islands. One of the apparent reasons for the speakers to choose the EL semantic/pragmatic feature bundles for the activation the EL lemmas is that in some cases the ML does not possess the same semantic/pragmatic feature bundles as those contained in the EL PP's. ''On sale'' is a relatively new concept for Chinese, and while English makes a slight distinction between ''out of order'' and ''breakdown'' and between ''on time'' and ''in time,'' Chinese does not. The speakers prefer the EL expressions because they more accurately convey their intended meanings. As mentioned above, because of cross-linguistic variation in the presence and conflation of semantic/pragmatic feature bundles, sometimes certain concepts or meanings are hard to translate across languages. As De Bot and Schreuder (1993) argued, language cues may have different values. By using compensatory strategies, the speaker may decide to ignore the ML cue and select the EL cue instead. The speakers may switch to the EL codes at a certain point during the discourse in order to get their intended meanings across. This is because some concepts are more easily expressed in one language than in the other.

Even if congruence at the conceptual level provides a match between the EL lemma and its ML counterpart, the ML morphosyntactic structure may reject the mapping. That is, incongruence may occur at the level of the speech production formulator. As mentioned above, Chinese and English share the same basic V-O order. However, in some cases, predicate-argument structures across the two languages may differ. If such incongruence occurs, but the speaker selects the EL lemma for his/her intention, a radical compromise strategy must be taken in order for the EL material to be accessed. That is, EL semantic/pragmatic feature bundles selected at the conceptual level must be realized in EL islands at the surface or positional level.

(18) ta jingchang bangzhu wo *with my computer work.*
he often help me
''He often helps me with my computer work.''

(19) wo meitian dei bangzhu ta zhuo *homework.*

I everyday have to help her do

''I have to help her do her homework everyday.''

While in (18) the THEME is introduced by the preposition ''with'' in the EL, in (19) the THEME is always introduced by a specific verb such as ''zhuo'' (''do'') in the ML. The speaker's selection of the EL material at the lexical-conceptual level is realized as the EL island because of the incongruence between the EL and the ML predicate-argument structure.

(20) tingshuo nei-ge *professor* hen *crazy.* ta jingchang *fails students in exams.*

hear that-Cl very she often

''I heard that professor is very crazy. She often fails students in exams.''

In (20) the VP headed by ''fail'' is an EL island (i.e., with all the system morphemes from the EL). In English ''fail'' can be used as a causative verb and thus takes the grammatical subject as the AGENT who makes the failure happen, but in Chinese ''shibai,'' which is the equivalent to ''fail'' but means ''be defeated in . . . ,'' is used only as a noncausative verb and thus takes the grammatical subject as the EXPERIENCER. Since the speaker prefers the EL concept, but there is incongruence between the EL and the ML predicate-argument structure, the result is an EL island.

(21) ni biye hou keyi *teach English to nonnative speakers.*

you graduate after can

''After you graduate you can teach English to nonnative speakers.''

In (21) the RECIPIENT is introduced by the PP headed by ''to'' (i.e., the indirect object dative structure). By contrast, the equivalent Chinese VP headed by ''jiao'' (''teach'') only permits the double object dative structure. Again, since the speaker selects the EL material at the level of lexical-conceptual structure, but the ML does not accept the mapping which the EL PP would project at the level of predicate-argument structure, the result is an EL island.

The above examples show that incongruence between the language pairs involved in intrasentential CS, either at the level of lexical-conceptual structure or at the level of predicate-argument structure, requires a compromise strategy in order for intrasentential CS to occur. In the case of intrasentential CS, incongruence at the lexical-conceptual level is mainly caused by incomplete match between the EL and the ML lexemes, and incongruence at the level of predicate-argument structure is caused by mismatch between the language pairs in their maximal projection of a category or grammatical argument structure. The compromise strategy for the EL material to be realized in intrasentential CS is to produce EL islands switched into the sentential frame set by the ML.

CONCLUSION

This article has demonstrated how intrasentential CS data provide some empirical evidence for certain specifications about the nature of the bilingual mental lexicon

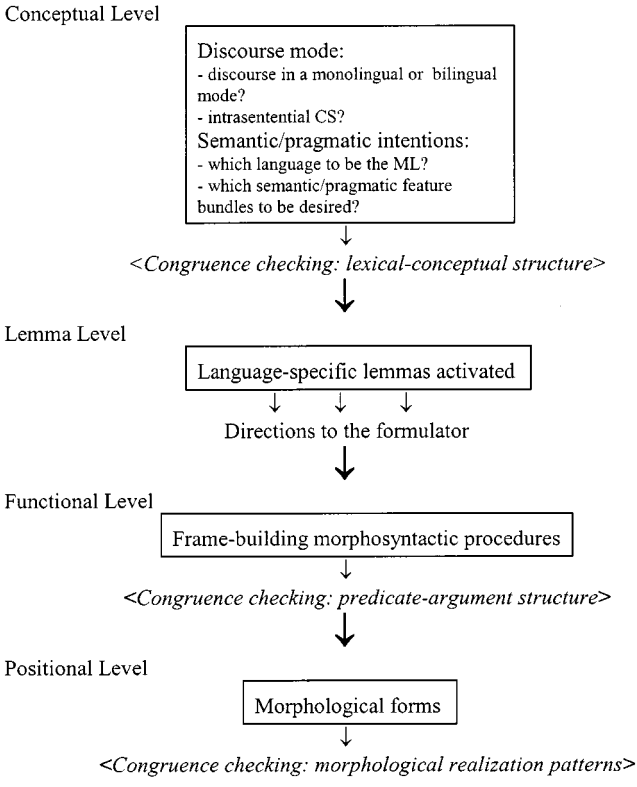

FIG. 2. Steps in bilingual speech production.

in relation to the mixed bilingual speech production process. Figure 2 illustrates the major steps that the bilingual follows during a discourse involving intrasentential CS.

At the conceptual level, the bilingual makes two types of decisions: discourse mode and semantic intentions. In making the decision on the discourse mode, the speaker considers whether to use the monolingual or bilingual mode for the discourse and, if the bilingual mode is chosen, whether to use intrasentential CS. Once the bilingual mode is chosen for the discourse, both languages are turned ''on'' throughout speech production. In making the decision on semantic/pragmatic intentions, the speaker considers which language to be the ML and desired semantic/pragmatic feature bundles. The language which is designated the ML is more activated than the EL in specific ways, since it is the ML that projects the overall frame for the sentences involving intrasentential CS. Then, the speaker will choose the most appropriate content morphemes from either the ML or the EL to realize his/her semantic/pragmatic intentions as desired.

The bilingual's intention to select either an EL or ML content morpheme activates an EL or ML lemma in the mental lexicon. If an EL lemma is selected, it must be checked for congruence with an ML lemma counterpart. The lemma congruence checking concerns the lexical-conceptual structure, including information about the predicate-argument structure and the morphological realization patterns associated with it.

At the lemma level, the activated language-specific lemmas send directions to the language production formulator at the functional level. The directions sent from the activated lemmas call frame-building morphosyntactic procedures in response to the predicate-argument structure and morphological realization patterns encoded in

those lemmas. The lemma congruence checking between the EL and the ML must come into play at the level of predicate-argument structure in order for the selected EL material to occur in the sentential frame set by the ML. If there is incongruence at this level, radical compromise strategies must be taken in order for the intended intrasentential CS to occur.

At the positional level, surface morphological patterns are realized. The congruence checking between the EL and the ML at the level of morphological realization patterns must also come into play in order for the language-specific surface forms to be realized.

The study has reached several conclusions. First, the bilingual makes choices at the conceptual level about the semantic/pragmatic information which he/she wishes to convey (i.e., intention before choice). Second, the bilingual's mental lexicon includes lemmas from both languages known, but these lemmas are tagged for their specific language (i.e., lemmas are language-specific). Third, although the bilingual's languages are ''on'' all the time during a discourse, they are never equally activated at the same time. The ML is more activated than the EL in terms of morphosyntactic frame building and frequency of occurrence of types of morphemes. Fourth, the bilingual can access lemmas from whatever language is the EL during a discourse involving intrasentential CS. However, these lemmas must be congruent with the ML counterparts in various ways; otherwise, radical compromise strategies must be taken in order for the EL material to be accessed and realized.

REFERENCES

Abney, S. P. (1987). The English noun phrase in its sentential aspect. In *MIT working papers in linguistics.* Cambridge, MA: MIT Press.

Beauvillain, C., & Grainger, J. (1987). Accessing interlexical homographs: Some limitations of a language-selective access. *Journal of Memory and Language,* **26,** 658–672.

Bierwisch, M., & Schreuder, R. (1992). From concepts to lexical items. *Cognition,* **42,** 23–60.

De Bot, K. (1992). A bilingual production model: Levelt's 'speaking' model adapted. *Applied Linguistics,* **13,** 1–24.

De Bot, K., & Schreuder, R. (1993). Word production and the bilingual lexicon. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 191–214). Amsterdam: John Benjamins.

Dell, G. S. (1986). A spreading activation theory of retrieval in sentence production. *Psychological Review,* **93,** 283–321.

Emonds, J. (1985). *A unified theory of syntactic categories.* Dordrecht: Foris.

Friederici, A. D., Weissenborn, J., & Kail, M. (1991). Pronoun comprehension in aphasia: A comparison of three languages. *Brain and Language,* **41,** 289–310.

Garrett, M. F. (1990). Sentence processing. In D. N. Osherson & H. Lasnik (Eds.), *An invitation to cognitive science* (Vol. 1, pp. 133–175). Cambridge, MA: MIT Press.

Grainger, J., & Dijkstra, T. (1992). On the representation and use of language information in bilinguals. In R. J. Harris (Ed.), *Cognitive processing in bilinguals* (pp. 207–220). Amsterdam: Elsevier.

Green, D. W. (1986). Control, activation and resource: A framework and a model for the control of speech in bilinguals. *Brain and Language,* **27,** 210–223.

Green, D. W. (1993). Toward a model of L2 comprehension and production. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 249–277). Amsterdam: John Benjamins.

Grosjean, F. (1997). Processing mixed languages: Issues, findings, and models. In A. M. B. De Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 225–254). Mahwah, NJ: Erlbaum.

Jackendoff, R. (1997). *The architecture of the Language Faculty.* Cambridge, MA: MIT Press.

Jake, J. L. (1994). Intrasentential codeswitching and pronouns: On the categorial status of functional elements. *Linguistics,* **32,** 271–298.

Jake, J. L. (1998). Constructing interlanguage: Building a composite matrix language. *Linguistics,* **36**(2), 333–382.

Jake, J. L., & Myers-Scotton, C. (1997). Codeswitching and compromise strategies: Implications for lexical structure. *International Journal of Bilingualism,* **1,** 25–39.

Joshi, A. (1985). Processing of sentences with intrasentential code switching. In D. R. Dowty, L. Karttunen, & A. M. Zwicky (Eds.), *Natural language parsing: Psychological, computational, and theoretical perspectives* (pp. 190–205). Cambridge, UK: Cambridge Univ. Press.

Levelt, W. (1989). *Speaking: From intention to articulation.* Cambridge, MA: MIT Press.

Levelt, W. (1995). The ability to speak: From intentions to spoken words. *European Review,* **3,** 13–23.

Li, D. C. S. (1996). *Issues in bilingualism and biculturalism: A Hong Kong case study*. New York: Peter Lang.

Myers-Scotton, C. (1993, 1997). *Duelling languages: Grammatical structure in codeswitching.* Oxford, UK: Clarendon Press.

Myers-Scotton, C., & Jake, J. L. (1995). Matching lemmas in a bilingual language competence and production model: Evidence from intrasentential code switching. *Linguistics,* **33,** 981–1024.

Myers-Scotton, C., & Jake, J. L. (2000). Explaining aspects of codeswitching and their implications. In J. Nicol (Ed.), *One mind, two languages: Bilingual language processing* (pp. 91–125). Oxford, UK: Blackwell.

Nishimura, M. (1997). *Japanese/English code-switching: Syntax and pragmatics*. New York: Peter Lang.

Paradis, M. (1981). Neurolinguistic organization of a bilingual's two languages. In J. E. Copeland & P. W. Davis (Eds.), *The seventh LACUS forum* (pp. 486–494). Columbia, SC: Hombeam Press.

Paradis, M. (1987). *The assessment of bilingual aphasia.* Hillsdale, NJ: Erlbaum.

Roelofs, A. (1992). A spreading activation theory of lemma retrieval in speaking. *Cognition,* **42,** 107–142.

Talmy, L. (1995). Lexicalization patterns: Semantic structures in lexical form. In T. Shopen (Ed.), *Language typology and syntactic description III* (pp. 51–149). New York: Cambridge Univ. Press.

Wei, L. (2000a). Unequal election of morphemes in adult second language acquisition. *Applied Linguistics,* **21**(1), 106–140.

Wei, L. (2000b). Types of morphemes and their implications for second language morpheme. *International Journal of Bilingualism,* **4**(1), 29–43.

Wei, L. (2001). Lemma congruence checking between languages as an organizing principle in intrasentential codeswitching. *International Journal of Bilingualism,* **5,** 153–173.